erecting a new boiler house and lavatories; is proposing to extend the refectory; is adapting a large dwelling house for the purposes of an extension of the geological department, and is uniting the house by means of a bridge at the first-story level with the present geological department of the University; and is adapting other dwelling houses for the use of women students and for seminar work.

THE second International Congress on School Hygiene will be opened on August 5, at the request of the King, by Lord Crewe. The complete success of the meetings seems to be assured. The German Government has not only decided to send delegates to the congress, but, by permission of the Kaiser, Prince Eitel Friedrich has accepted the office of a vice-patron of the congress. While still adhering to its resolution not to issue official invitations to foreign Governments to send delegates, the Board of Education has arranged with the Foreign Office to take such steps as are likely to remove any misunderstanding which might have prevented some foreign delegates from accepting the invitations issued. The meetings will be held at the University of London, and will last until August 10. Sir Lauder Brunton, F.R.S., the president, will deliver the inaugural address on August 5. The sectional meetings will commence on the following day. There are eleven sections in all; their subjects and the name of the president in each case are as follows:—(1) The physiology and psychology of educational methods and work, Sir James Crichton Browne, F.R.S.; (2) medical and hygienic inspection in school, Prof. W. Osler, F.R.S.; (3) the hygiene of the teaching profession, Dr. T. J. Macnamara, M.P.; (4) instruction in hygiene for teachers and scholars, Sir William J. Collins, M.P.; (5) physical education and training in personal hygiene, Sir John W. Byers; (6) out-of-school hygiene, holiday camps and schools: the relation of home and the school, Lord Kinnaird; (7) contagious diseases, ill-health, and other conditions affecting attendance, Sir Shirley F. Murphy; (8) special schools for feeble-minded and exceptional children, Mr. W. H. Dickinson, M.P.; (9) special schools for blind, deaf and dumb children, Lord Crewe; (10) hygiene of residential schools, Dr. Clement Dukes; (11) the school building and its equipment, Mr. T. E. Colcutt. An exhibition of school building and furnishing appliances has been arranged in connection with the congress.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, June 6.—"On the Two Modes of Condensation of Water Vapour on Glass Surfaces, and on their Analogy with James Thomson's Curve of Transition from Gas to Liquid." By Prof. Fred. T. **Trouton**, F.R.S.

Experiments made with glass wool to determine the amount of water condensed on the surface of glass when in equilibrium with various vapour pressures showed that below a critical pressure, which is about 50 per cent. saturation, there are two distinct modes in which the condensed water can exist.

Thus for the same vapour pressure, if the condensation is in one of these forms, called for convenience the $\alpha$ type, there is much less condensed material present on the surface than in the other form, called the $\beta$ type; or, to put it in another way, for the same amount of condensed vapour the pressure is greater when the condensation is of the $\alpha$ form than when it is of the $\beta$ form.

Condensation will take place of the $\alpha$ type if the surface has been thoroughly dried at high temperatures, while of the $\beta$ type if the drying has only been effected at ordinary temperatures, though in that case also the vapour pressure may be zero.

When the condensation is of the $\beta$ type the curve, connecting pressure with the amount of condensed water, is found to be very similar to that for wool or cotton, but when the condensation is of the $\alpha$ type the curve is quite different. Thus, starting with the surface very dry, the pressure runs up quickly for relatively little condensation until a critical pressure is reached; after that, on further additions to the surface condensation, the pressure diminishes. This is attributed to a transformation into the $\beta$ state supervening at this point, when consequently the vapour pressure is in excess of equilibrium, and thus a depletion of the vapour in the surrounding space results, with a corresponding fall in vapour pressure. If moisture be continuously supplied the pressure will, after reaching a maximum, begin to rise, and ultimately pass to saturation.

The analogy with James Thomson's curve of transition from gas to liquid is pointed out. In the one case there is attraction between water-vapour particle and water-vapour particle, in the other between glass and water vapour. The condensation of the $\alpha$ type corresponds to the supersaturated vapour stage in the transition curve, while the $\beta$ corresponds to its liquid stage.

Where the surface is not completely dry, the fact that the condensation is in the $\beta$ form, on vapour coming in contact with the surface, is attributed to there being an example of that type already on the surface; but if this is not present, that is, if the surface is desiccated, the condensation is of a type allied to supersaturated vapour rather than to the liquid.

A paradoxical consequence of there being these two modes of condensation is pointed out, namely, that a relatively wet surface is capable of drying one wetter than itself.

As an illustration of the phenomenon a simple experiment is given, in which two dishes of phosphorus pentoxide are placed under a bell jar, with only this difference, that one of the dishes is first made dry by heating. It is then found that the pentoxide which can initially obtain some moisture from contact with the damp dish absorbs the moisture in the bell jar, and ultimately runs liquid, while the other remains dry.

"On the Velocity of Rotation of the Electric Discharge in Gases at Low Pressures in a Radial Magnetic Field." By Prof. H. A. **Wilson**, F.R.S., and G. H. **Martyn**.

The apparatus used in this investigation was a small vacuum tube consisting of two concentric glass tubes cemented into aluminium discs. The discs served as electrodes, and the discharge was passed between them through the annular space between the glass tubes.

An iron bar was fixed along the axis of the vacuum tube, and could be magnetised so as to produce a radial field in the space between the glass tubes.

The discharge was produced by a large secondary battery, and its velocity of rotation round the annular space was measured. The variation of the velocity with the strength of the magnetic field, with the pressure of the gas, and with the current carried by the discharge, was investigated in air, nitrogen, and hydrogen.

The velocity was found to be nearly proportional to the strength of the magnetic field and inversely proportional to the gas pressure. The velocity in hydrogen was about thirteen times the velocity in air or nitrogen.

It is shown that theoretically the velocity should be proportional to the product of the two ionic velocities, and the results obtained, together with previous measurements of the Hall effect, enable the velocities of both the positive and negative ions to be calculated. The negative ions are found to have much higher velocities than the positive ions.

June 13.—"*Miadesmia membranacea*, Bertrand; a New Palæozoic Lycopod with a Seed-like Structure." By Dr. M. **Benson**. Communicated by Dr. D. H. Scott, F.R.S.

The vegetative organs of this interesting new type were discovered by Bertrand in 1894. He found them in sections of a calcite nodule from the Gannister beds of Hough Hill, England. A large quantity of new material has become available, and now not only are more details known as to the vegetative organs, but a fairly complete knowledge of the reproductive organs is possible.

Miadesmia was exceedingly minute, its stem slender and without any trace of skeletal tissue. It is the first Palæozoic Lycopod of herbaceous character known structurally. The megasporophylls, which were identified by Dr. D. H. Scott, F.R.S., in 1901, show a more advanced

type of seed habit than has hitherto been met with in Cryptogams. The megasporange gives rise to but one thin-walled spore, which in development and structure resembles an embryo sac and germinates *in situ*. An integument surrounds the sporange, leaving but a small orifice as micropyle. This is surrounded by numerous long processes of the integument, which formed a collecting and incubating apparatus for the microspores. There is no trace of an envelope about the microsporange. The carpellary leaf was shed at maturity, and resembles a winged seed.

Disregarding the structural modifications of the megasporophyll, the nearest affinity of Miadesmia among forms so far known seems to be with the non-specialised species of Selaginella, such as *Selaginella selaginoides*, but the foliage leaves show the archaic leaf-base comparable with that of Lepidodendreæ.

"The Inhibitory Action upon Subsequent Phagocytosis, exerted on Active Normal Serum by Inactive Normal Serum through which Bacilli have been passed." By J. C. G. **Ledingham.** Communicated by Dr. C. J. Martin, F.R.S.

When inactivated normal serum is digested with tubercle bacilli, and finally freed therefrom by the centrifuge, it is found that the supernatant fluid has the property of inhibiting to a great extent the opsonic action of fresh normal serum, not only towards the tubercle bacillus, but also towards the *Staphylococcus pyogenes aureus*. The author interprets the phenomenon thus:—The amboceptors of heated normal serum combine with the tubercle bacilli and also with their free receptors, which remain in the supernatant fluid after removal of the bacilli. When this supernatant fluid containing the "free receptor amboceptor" combination, is added to fresh normal serum, the latter's complement becomes fixed, and consequently in the presence of fresh bacilli, opsonic action is inhibited. The experimental results obtained lend support to the view that the opsonic action of normal serum depends on the cooperation of complement with normal amboceptor.

June 20.—"Preliminary Note on a New Method of Measuring directly the Double Refraction in Strained Glass." By Dr. L. N. G. **Filon.**

If a plane wave of light be passed horizontally through a rectangular slab of glass under flexure in a vertical plane, it is broken up into two components polarised horizontally and vertically.

The light of either component suffers, owing to the stress, an additional retardation proportional to its distance from the "neutral axis," *i.e.* the mid-level of the slab. Thus the wave-front on emergence is no longer vertical, but has suffered a deviation proportional to the bending moment applied. The two components, however, are deviated by different amounts.

If the light be then analysed by a grating, the lines of the spectrum formed will be shifted, in consequence of the change in the angle of incidence. In addition, owing to the different shifts of the two components, each line appears doubled.

Experiment shows that the effect is quite measurable, and provides a new method for measuring directly the doubly refracting effect of stress, giving, not only the difference between the retardations of the two components, but the absolute amounts of each.

With a grating of 14,000 lines to the inch, the maximum separation of the components, for lines in the yellow, was about the distance between the two D-lines.

"On the Origin of the Gases evolved by Mineral Springs." By the Hon. R. J. **Strutt,** F.R.S.

It has long been known that thermal springs, such as those at Bath, give off considerable quantities of gas, which bubbles up with the water, and consists, for the most part, of nitrogen. Of recent years, interest in this subject has been revived by Lord Rayleigh's observation that helium and argon are present along with nitrogen.

It has been found that such gases, when fresh, are rich in radium emanation, and that the deposit thrown down by the water on standing contains a notable quantity of radium. It is natural to connect this observation with the discharge of helium by the springs. The author was formerly inclined to think that the facts were most easily explained by supposing that the supplies of helium and radium were derived from the disintegration of uranium lodes at a great depth by the water, but this view scarcely seems compatible with the universal presence of helium and radium in mineral springs, which has since been brought to light; for uranium lodes are very rare near the earth's surface, and there are fatal objections to supposing that metal to be generally more abundant at greater depths.

The unexpectedly large quantities of radium found in common rocks led the author to suspect that perhaps they might after all be able to supply the helium and radium products, as well as the ordinary gases and saline constituents of the spring. With the view of deciding this question, he has examined the inert portion of the gases given off by several varieties of rock on heating. The subject has attracted some attention from previous experimenters.

The results for two normal rocks were as follows:—

*Matopo Granite. Quantity taken, 850 grams.*

The inert residue consisted of

| | |
|---|---|
| Nitrogen ... ... ... ... ... | 11 c.c. |
| Argon ... ... ... ... ... | 0·14 c.c. |
| Helium ... ... ... ... ... | 0·03 c.c. |
| Neon ... ... ... ... ... | traces |

*Syenite Rock, Mt. Sorrel, Leicestershire. Quantity taken, 900 grams.*

Inert residue—

| | |
|---|---|
| Nitrogen ... ... ... ... ... | 9 c.c. |
| Argon ... ... ... ... ... | 0·026 c.c. |
| Helium ... ... ... ... ... | 0·010 c.c. |
| Neon ... ... ... ... ... | traces |

In both these cases, the vacuum tube, after removal of argon, gave a brilliant yellow helium glow.

We may compare these analyses with the composition of the Bath gas, as a type of the gases evolved by mineral springs. The total volume of inert gas (mainly nitrogen) is taken as 100.

| Gas | Argon | Helium | Neon |
|---|---|---|---|
| | Per cent. | Per cent. | |
| Bath spring ... ... | 1·5 | 0·12 | traces |
| Matopo granite ... ... | 1·27 | 0·36 | traces |
| Syenite, Mt. Sorrel ... | 0·29 | 0·11 | traces |

These figures make it fairly clear that there is a general resemblance between the gases of mineral springs and the gases of rocks, so far as nitrogen and the other inert constituents are concerned.

In addition to these constituents, rocks give off hydrogen, carbonic oxide, carbonic acid, and a little methane. The two former are probably secondary products, produced by chemical actions set up on heating. Carbonic acid is represented at the spring by the dissolved carbonates of the mineral water, while methane is present in the evolved gases. The author thinks, therefore, that we may consider that the disintegration and partial solution of ordinary rocks by water at a high temperature accounts for the gaseous, as well as the solid, products, delivered by springs such as those at Bath.

With regard to the primary origin of the argon and neon contained in rocks, the author has no theory to offer. It is natural, however, to associate the helium of rocks with the radium they contain. The relative quantities are quite in accordance with such a view, for the ratio is of the same order as in the strongly radio-active minerals. The author hopes to discuss this subject in detail in a future paper. He has found at least traces of helium in almost all of a considerable collection of ores and other minerals, but hitherto only one case has been found—in certain beryls—where there seems to be sufficient reason to look for any other cause than traces of the radio-active elements to explain its presence. The evidence so far obtained is not favourable to the view that the ionising radiation from ordinary substances is accompanied by production of helium.

June 27.—"On a Standard of Mutual Inductance." By Albert **Campbell.** Communicated by Dr. R. T. Glazebrook, F.R.S.

The author has designed a standard of mutual inductance of such a nature that its value is accurately calculable from the dimensions, and large enough to give good sensitivity in actual use. A high enough value (say 0·01 henry) can be got by having one of the associated circuits a coil of many layers. The objections to such a coil are overcome as follows:—

The primary circuit is a pair of single-layer coils wound on a single marble cylinder; their dimensions can be accurately determined. The secondary is a coil of many layers co-axial with, and midway between, the two primary coils, and of such radius that the mutual inductance is a maximum for change of radius. A series of curves is given from which the proper dimensions were chosen. All round the mean circumference of the secondary coil the magnetic field due to the current in the primary coils is zero, and is very nearly so over the section of the winding, thus allowing accurate calculation. The principle is applicable to other problems involving mutual inductance.

PARIS.

**Academy of Sciences,** July 22.—M. A. Chauveau in the chair.—A phenomenon resembling the spheroidal state: G. **Lippmann.** A strip of plaster of Paris adhering to a plane surface of glass becomes detached on raising the temperature above 100°, sliding over the surface with the greatest ease.—The effect of oxygen, osmotic pressure, acids, and alkalis in experiments on parthenogenesis: Yves **Delage.** The presence of oxygen is not necessary for the determining of parthenogenesis in starfish—it is even harmful; the presence of divalent ions is not at all essential, a solution of sodium chloride being often sufficient among sea-urchins. The requisite condition of parthenogenesis among certain of the latter consists in the treatment of the eggs by an acid solution, afterwards an alkaline, the first coagulating, the second liquefying certain constituents of the egg protoplasm.—The dielectric cohesion of helium: E. **Bouty.** By repeated purifications, the value of the dielectric constant was found to be reduced from 61·8 to 18·3.—The effect indicated by the electrolytic detector: M. **Tissot.**—A new optical property of magnetic bi-refraction belonging to certain non-colloidal organic liquids: A. **Colton** and H. **Mouton.** Nitrobenzene shows a magnetic bi-refraction of positive sign, increasing proportionally to the square of the field and the thickness traversed. This property is more or less marked throughout the aromatic series, but not among aliphatic compounds.—The spectrophotography of minerals in different regions of the spectrum; galena and argyrite: A. **de Gramont.**—The coagulation of albumins by the actions of ultra-violet light and radium: Georges **Dreyer** and Olav **Hanssen.** Both serous and egg albumin are coagulated under the action of a prolonged intense light. The serum of the horse is only slightly coagulated by light; a solution of peptone remains clear, though becoming yellow, the same effect being also noticeable with casein. These results are all due to the ultra-violet portion of the light. Radium coagulates vitellin, but apparently no others.—The heats of formation of alkaline protoxides: E. **Rengade.**—A mixed anhydride of sulphuric and nitric acids: Amé **Pictet** and Georges **Karl.** Nitric anhydride dissolves with evolution of heat in freshly distilled liquid sulphuric anhydride. The product distils entirely at 218°–220°, and analysis shows it to have the composition $(SO_3)_4N_2O_5$.—The combination of nickel and cobalt with boron: Binet **du Jassonneix.** Compounds have been obtained of the composition NiBo and CoBo (already described by M. Moissan), $Ni_2Bo$, $Co_2Bo$, $NiBo_2$, and $CoBo_2$.—A new silicide of platinum: P. **Lebeau** and A. **Novitzky.** This compound, of the formula SiPt, can be obtained by direct union, is crystallisable, and chemically resembles platinum.—A general method of preparation of anhydrous metallic bromides, with oxides as a starting point: F. **Bourion.** The simultaneous use of sulphur chloride and hydrogen bromide gas provides a convenient means to this end.—The alloys of nickel and tin: Em. **Vigouroux.**—The effect of electric sparking upon a mixture of nitrogen and oxygen at low temperatures: E. **Briner** and E. **Durand.**—Discontinuities observed in the molecular conductivity of dissolved chromium sulphates: Albert **Colson.**—The rotatory power of the proteids extracted from the flour of cereals by aqueous alcohol: M. **Lindet** and L. **Ammann.**—Menthane 1 : 8-dicarboxylic acid and a new dicyclic ketone: Ph. **Barbier** and V. **Grignard.**—The origin of the deposits of colouring matter in red wine: V. **Martinand.**—Malic acid in wine must, and its destruction in fermentation: W. **Mestrezat.**—The liquefaction by diastase of fecula starch: A. **Fernbach** and J. **Wolff.**—Living reagents and diffusion: Michel **Yégounow.**—A new genus of Sapotaceæ in West Africa, with seeds containing an edible fatty matter: Aug. **Chevalier.** This tree provides a fine red well-veined wood, of density almost equal to unity.—The Pachypodium of Madagascar: MM. **Costantin** and **Bois.**—New researches on the cytology of the seeds of Graminaceæ: A. **Guilliermond.**—The morphological value of the caruncle of *Notopygos labiatus*: A. **Malaquin** and A. **Dehorne.**—The destructive function of the spleen towards trypanosomes: A. **Rodet** and G. **Vallet.** In the case of infection by *Trypanosoma brucei*, the spleen actively destroys the parasites.—The injection of artificial serums: C. **Fleig.** Those containing iron have been used with success in many cases of chlorosis.—The activity of Etna: A. **Riccò.**

CALCUTTA.

**Asiatic Society of Bengal,** July 3.—Notes on the Pollination of flowers in India. Note No. 4. On cotton in Behar: I. H. **Burkill.** The flowers of *Gossypium neglectum* and *G. intermedium* in Behar are a little visited by insects, chiefly small Hymenoptera of the genera Ceratina and Halictus, which seek honey in vain and may collect pollen. Longer tongued insects, such as Xylocopa, Anthophora, and a few Lepidoptera only rarely go to the flowers. Plants intermediate between the two species, which are grown mixed, testify to the occurrence of cross-fertilisation; but they are rare, and the very early self-pollination in the flowers shows how much more the cotton crop depends on spontaneous self-fertilisation than on pollination by insects or other external agency.

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